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ABSTRACT

Acquisition of the basic concepts of mathematics such as matching, number and counting, sets and classifying, comparing, measuring, shape, space, and parts and wholes, may be followed by two types of activities. First, the child may subsequently be presented activities that allow for practice and generalization of those acquired concepts. Secondly, the child may be presented activities that extend the use of basic concepts into more advanced learning situations. Games provide practice and generalization. Cuisenaire rods may provide higher level mathematical experiences appropriate for preschool children. This document provides 7 guidelines for the selection and use of games with very young children. In addition, a brief explanation is given for addition, subtraction, multiplication, and division using Cuisenaire rods; this is preceded by an explanation of building a staircase with the rods. (Author/MK)

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MATH EXPERIENCES FOR PRESCHOOL CHILDREN:

GAMES AND CUISENAIRE RODS

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Acquisition of the basic concepts of math such as matching, number and counting, sets and classifying, comparing, measuring, shape, space and parts and wholes may be followed by two types of activities. First, the child may subsequently be presented activities that allow for practice and generalization of those acquired concepts. Secondly, the child may be presented activities that extend the use of basic concepts into more advanced learning situations. Games may provide practice and generalization. Cuisenaire rods may provide higher level math experiences appropriate for preschool children.

Games

Generic games that involve basic math skills are lottos, bingos, spinner games, board games, finger plays and songs (e.g., Baratta-Lorton, 1972; Charlesworth and Radeloff, 1978). Often these games involve one-to-one matching (lotto and bingo), numeral recognition and counting (spinner and board games) and set recognition (dice), but games can be devised for practice in classification, comparison, shape, space and parts and whole. The purpose here is not to describe such games but rather to provide guidelines for the selection and use of those games with very young children. Basically, there are seven guidelines:

1. Skills required in a game should have been introduced previously. Games are not to teach skills but to provide

practice and generalization of skills already acquired. Games need a fairly fast pace for excitement; learning new skills slows the game and dulls the fun. Furthermore, the range of skills in a game should not be so broad that a child has to wait forever to be able to play the game.

2. Themes or pictures of interest should be incorporated. Star Wars and Superman are currently popular and exciting to children.
3. Playing turns should come quickly. More than three children playing a game makes waiting for one's turn interminable.
4. Success should be assured for each player. Games should be continued until each child successively becomes a winner. One game may have three winners. Games should be designed to be completed within 5-10 minutes.
5. Motor skills required for the game should be possible for each child. Can the child spin the spinner or throw the dice? Are the squares on the board large and distinct enough for the child to move the marker in and out of them? Are the cards a convenient size to handle? Is the entire gameboard accessible? All children should be active in the game; a helper should not play the game for a child.
6. One child should know the skills well enough to check the correctness of another child's response. This situation promotes child independence in playing a game.

7. In the case of fingerplays or songs, the verse should be a reasonable length to memorize, the words easy to pronounce and the musical key appropriate to a child's voice.

Cuisenaire Rods

Cuisenaire rods, which may be used for higher level math activities, are in keeping with a child's way of thinking. A child's thought is tied to the senses. A child thinks by looking at, feeling and manipulating the environment. The Cuisenaire Rods are visual and tactile embodiments of number; the child actually sees and feels twoness, for example. By manipulating the rods in a specified manner a child may learn the concepts of addition, subtraction, multiplication and division. Many preschool children are able to learn to add and subtract with the rods, especially using the number concepts of 1 through 5. Those who are not ready for the rods should be taught the preskills to be described later. Ten percent of kindergarten children may learn to multiply with the rods. Fewer than ten percent learn to divide. It is advantageous for the preschool teacher to know how to add, subtract, multiply and divide to be prepared for the gifted child. Therefore, a brief explanation will be given for these four mathematical procedures using the Cuisenaire rods. Preceding these four procedures will be an explanation of building a staircase with the rods, which is the key to solving all the mathematical problems.

Staircase

The staircase is the vertical placement of the rods side-by-side in one-more order on an orange rod base. The smallest rod

(white) is on the left and the largest rod (orange) is on the right. Following are the steps to teaching a child to build a staircase and other related information:

1. a. The bottom brace (orange rod) is placed horizontally.
   b. Build staircase from left-to-right beginning with the smallest rod (white) in a vertical position above the orange base.
   c. After the white rod is placed, tell the child that the next step is one white rod more. A second white rod is placed on top of the first white rod, and the child is to find another rod that is the same height as the two white rods together (the red rod). Continue building from left-to-right always adding one white rod on top of the "CURRENT" rod. This is called the one-more order staircase.
   d. After the staircase is built, count left-to-right touching each rod and saying 1 rod, 2 rod, 3 rod, etc.
   e. Then ask the child why this is the 2 rod? Tell the child that it is the 2 rod because it is equal to 2 white rods or 2 one rods. Continue, why is this the 3 rod? Have the child give these explanations back to you. This is very important. The child should not use the staircase to work problems until you are assured that the reasoning behind the staircase is understood.
2. Do not have the child memorize the staircase nor that the white rod is one, the red rod two, etc. The stair-

case and the color/number correlation becomes an integral part of the child's knowledge after working with the rods for awhile.

3. Each child works problems with his/her own staircase at the side for a referent in checking the number name of each rod. Eventually the child will discard the staircase voluntarily and work problems without it.
4. Remember when using the rods preferably use the number names only, or initially use a combination of color and number, "Hand me the two red rods. Find the black seven rod."
5. Do not start the worksheets until the child can point to a color and tell you what number it is.
6. Any time the child has a problem with addition or subtraction go back to the white rods, then use the colored rods. Have the child verbalize while working the problem.

Example of Addition with Rods and Worksheet

1. Read while pointing to the problem - 2 + 3 = _____.
2. Place corresponding rods on numerals 2 and 3 (red & green).
3. Place the 2 and 3 rods end-to-end, and find the rod that matches the two together (yellow).
4. Count up the staircase to yellow. It is the fifth rod from left-to-right. The answer is 5.
5. Write 5 in the box.

Example of Subtraction with Rods and Worksheet

1. Read the problem - 5 - 3 = _____.
2. Place corresponding rods on numerals 5 and 3 (yellow and

green).

3. Place the green rod (minus rod) on top of the yellow rod.
4. Find the rod that fills the empty space (red).
5. Count up staircase to red rod which is the second rod. The answer is 2.
6. Write 2 in the box.

Example of Multiplication with Rods and Worksheet.

1. Read the problem -- 3 x 2 = _____.
2. Place the 3 green rod vertically like a smokestack.
3. Place as many red rods horizontally along the green rod as will fit (3 red rods).
4. Discard the green rod smokestack.
5. Place red rods end-to-end like a train.
6. Find the rod that matches the red train (green rod).
7. Count up the staircase from left-to-right stopping at green the sixth rod. The answer is 6.
8. Write 6 in the box.

Example of Division with Rods and Worksheet

1. Read the problem -- 10 ÷ 2 = _____.
2. Place the orange 10 rod in a lying down (horizontal) position.
3. Find out how many red rods will fit on top of the 10 orange rods (5 red rods).
4. Count the number of red rods -- 5. The answer is 5.
5. Write 5 in the box.

Preskills

The preskills needed for working with the Cuisenaire rods may be divided into two categories -- the preskills for

building the staircase and the preskills for using the rods with math worksheets. A list of each category follows:

Staircase Preskills

1. Left-right tracking.
2. Concept of one-more.
3. Concept of "up and down" (vertical) and "lying down" (Horizontal).
4. Counting objects one-by-one.
5. Color recognition or matching which helps to locate the correct rod.
6. Fine muscle coordination.
7. Counting from 1-10.
8. Concept of sets.
9. Concept of one-to-one matching (one-to-one correspondence).

Worksheet Preskills

1. Numeral recognition.
2. Writing numerals.
3. Numeral to quantity recognition and understanding.
4. Concept of match (equal).
5. Concept of empty space.

Summary

The understanding of basic mathematical concepts takes training, experience and time. Initially, young children learn these basic concepts either through informal or formal training. Once the concepts are learned the child needs more experience with them. The child needs to practice the concepts and generalize them to different situations. Games may aid this practice and

generalization. Eventually, the child needs to extend the basic concepts, that have been practiced again and again, to higher levels of understanding. Cuisenaire rods are appropriate materials for a child to begin to explore higher levels of mathematics.

References

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